

THE U.S. DEPARTMENT OF ENERGY'S OFFICE OF FOSSIL ENERGY

TAPPING THE FULL POTENTIAL OF AMERICA'S TRADITIONAL ENERGY RESOURCES

ENSURING FOSSIL ENERGY RESOURCE AVAILABILITY

FOSSIL ENERGY — COAL, OIL, AND NATURAL GAS — IS ESSENTIAL FOR U.S. ECONOMIC GROWTH AND NATIONAL SECURITY, BOTH NOW AND IN THE FUTURE. FOSSIL FUELS CURRENTLY ACCOUNT FOR A COMBINED 86 PERCENT OF DOMESTIC ENERGY CONSUMPTION, A SHARE THE ENERGY INFORMATION ADMINISTRATION PROJECTS WILL BE MAINTAINED THROUGH AT LEAST 2030.

Consequently, the U.S. Department of Energy's Office of Fossil Energy (FE) has a key role in

helping America meet its continually growing need for secure, reasonably priced, and environmentally sound fossil energy supplies. Put simply, FE's primary mission is to ensure the nation can continue to rely on traditional resources for clean, affordable energy.

FE's staff consists of about 1,000 scientists, engineers, technicians, and administrative staff, with headquarters locations in downtown Washington, D.C., and in Germantown, MD. The office also includes the National Energy Technology Laboratory (NETL) with locations in Morgantown, WV; Pittsburgh, PA; Tulsa, OK; Albany, OR; and Fairbanks, AK. Key programs at NETL include the development of advanced coal, natural gas, and oil technologies. FE also maintains and operates the Strategic Petroleum Reserve (SPR), based in New Orleans, LA; and the Rocky Mountain Oilfield Testing Center (RMOTC) in Casper, WY.

Innovative FE R&D programs are leading efforts to make possible greater reliance on the nation's most abundant energy resource: coal. This includes implementation of a \$2 billion, 10-year initiative to develop a new generation of environmentally conscious clean coal technologies; and the FutureGen Initiative, a \$950 million, coal-fueled prototype plant that will co-produce electricity and hydrogen while preventing air pollutants and greenhouse gases from being released into the atmosphere. Other key coal R&D programs include pollution

control innovations for traditional power plants, including mercury reduction; improved gasification technologies; advanced combustion systems; development of stationary power fuel cells; improved turbines for future coal-based combined cycle plants; and creation of a portfolio of technologies that can capture and permanently store greenhouse gases.

About two-thirds of the nation's petroleum cannot be extracted economically with conventional means. Historically, FE programs have examined how more efficient approaches for improved extraction might enable this unused resource to play an expanded role in supplementing the national petroleum supply. In recent years, FE has also looked at how natural gas production and utilization might be increased through improved characterization of reserves and through better infrastructure.

As part of its responsibility for the SPR, FE has initiated proceedings to select sites needed to expand the Reserve from its current 727 million barrel-capacity to 1 billion barrels, as directed by the Energy Policy Act of 2005 — an action that will further minimize the threat of severe oil supply disruptions. FE also manages the 2-million-barrel emergency Northeast Home Heating Oil Reserve and the Naval Petroleum and Oil Shale Reserves, which control oil-bearing lands owned by the U.S. government.

Taken as a whole, FE's activities help ensure that as the nation strives to reduce its reliance on imported energy sources, new technologies and methodologies will be in place to promote the efficient and environmentally sound use of America's abundant fossil fuels.

WWW.FOSSIL.ENERGY.GOV



REALIZING THE PROMISE OF CLEAN COAL

IMAGINE A FUTURE IN WHICH POWER FROM OUR NATION'S MOST ABUNDANT AND LOWEST COST ENERGY RESOURCE IS POLLUTION-FREE. IMAGINE A FUTURE IN WHICH WE NO LONGER HAVE CONCERNS ABOUT THE EFFECTS OF POWER AND FUELS PRODUCTION ON THE GLOBAL CLIMATE OF OUR CHILDREN, OR THEIR CHILDREN. IMAGINE A FUTURE IN WHICH AMERICA'S ENERGY SECURITY IS STRENGTHENED BY REPLACING INCREASING AMOUNTS OF IMPORTED OIL WITH CLEAN-BURNING, AFFORDABLE FUELS MADE FROM RESOURCES THAT EXIST WITHIN OUR BORDERS.

The U.S. Department of Energy's (DOE) Office of Clean Coal is working to make this future possible. For the first time in the long history of fossil fuel use, we now see emerging from our laboratories and test sites the tools and technologies that can turn the concept of a virtually zero-emission, coal-based energy plant into a viable reality — not 50 or 100 years into the future — but within the coming decade. Through sustained investments in coal science and technology, and through partnerships with the nation's energy industry and increasingly with other nations, we hope to bring about a revolutionary change in the way power and fuels are produced from coal.

Our strategy calls for investments in advanced power systems that will form the core of this new breed of energy plant. It supports the development of lower-cost fuel cells and fuel cell/turbine hybrids that can transform the way power is generated in the future. It looks to advance new, more affordable methods to extract commercial-grade hydrogen from coal. It continues to expand the world's understanding of the potential for capturing and permanently sequestering carbon dioxide (CO₂). It recognizes that continuing to probe the fundamental nature and behavior of coal can produce the breakthroughs that could dramatically accelerate our progress along the path to a pollution-free coal plant.

The strategy of developing a new integrated concept for a zero-emission plant does not mean

that we are abandoning efforts to provide better technologies for the existing fleet of coal power plants that provide more than half the nation's electricity. Indeed, a high priority effort in the Office of Clean Coal is to expand the options available to current plant operators for meeting new mercury regulations, as well as achieving additional reductions in nitrogen oxide, particulate matter and by-products of combustion from existing coal plants. Given the nation's expected continued reliance on coal for electricity production, developing improved efficiencies and innovative pollution control technologies that can be applied to existing power plants is essential for assuring this important energy supply remains reliable and affordable, while meeting environmental objectives.


The preeminent project in the Office of Clean Coal's long-range R&D program is the FutureGen project. When it becomes operational in the next decade, FutureGen will produce both electricity and commercial-grade hydrogen — the first plant in the world to produce these two products simultaneously. It will emit virtually no airborne pollutants. No wastewater will be discharged. Solid wastes will be converted to commercially valuable, environmentally benign products. Carbon gases will be captured before they escape into the atmosphere. FutureGen will be the forerunner of futuristic power plants that could essentially eliminate environmental concerns over the use of coal.

February 2006



DOMESTIC HYDROCARBON RESEARCH

OVER THE YEARS, THE U.S. DEPARTMENT OF ENERGY'S (DOE) OFFICE OF OIL AND NATURAL GAS HAS SUCCESSFULLY DEVELOPED TECHNOLOGIES IN PARTNERSHIP WITH THE OIL AND GAS INDUSTRY THAT LOCATE AND PRODUCE HYDROCARBONS CURRENTLY BEYOND THE REACH OF INDUSTRY CAPABILITIES IN WAYS THAT ALSO PROTECT SENSITIVE ENVIRONMENTS.



Consequently, DOE's Office of Fossil Energy's (FE) oil and gas research and development (R&D) program has historically been oriented toward fundamental research and future innovations in exploration, drilling, and production that go beyond the traditional shorter-term focus of the oil and gas industry. FE determined last year, however, that the industry has the capacity and economic wherewithal to pursue this research without government participation and proposes to stop these efforts in FY 2007.

Natural gas use in the United States is likely to increase by about 30 percent by 2020. FE's natural gas research program, therefore, has recently aimed at providing new tools producers can use to diversify future supplies of gas. Previous research focused on improving access to onshore public lands, especially in the Rocky Mountains, which hold much of our undiscovered gas resource.

FE has also studied ways to obtain natural gas from methane hydrates — ice-like formations in Alaska and offshore — that could potentially add massive new supplies of natural gas to the nation's energy future. U.S. Geological Survey estimates indicate the nation's gas hydrates are larger than the estimated 1,400 trillion cubic feet

of domestic conventional recovered gas resources and reserves. Advanced technology might one day reliably and cost-effectively detect and produce natural gas from methane hydrates.

Recently, FE's Oil Technology program focused on working with industry and universities to sustain access to marginal wells and reservoirs. These aging fields account for 40 percent of our domestic production and contain billions of barrels of oil that might still be recovered with ever-improving technology. "Micro hole" technology — integrating smart drilling systems, advanced imaging, and enhanced recovery technologies into a complete exploration and production system — is one way FE is working to keep marginal fields active.

Carbon dioxide (CO₂) injection is a proven method for increasing oil recovery and prolonging the life of some mature fields, but has not been used to its full potential because of insufficient supplies of economical CO₂. In recent years, FE has explored new approaches, including integrating injection with CO₂ captured and delivered from fossil fuel plants, which would both boost future oil production and contribute to greenhouse gas mitigation.

February 2006



MAINTAINING EMERGENCY PETROLEUM RESERVES

IF A DISRUPTION IN COMMERCIAL FUEL SUPPLIES
THREATENS THE WELL-BEING OF THE NATION'S CITIZENS
OR THE NATIONAL ECONOMY, THE UNITED STATES
CAN TURN TO TWO EMERGENCY STOCKPILES OF OIL
MAINTAINED BY THE OFFICE OF FOSSIL ENERGY (FE).

THE STRATEGIC PETROLEUM RESERVE (SPR) is the largest

government-owned inventory of emergency crude oil in the world. With a current capacity of 727 million barrels securely stored in deep, underground salt caverns along the Texas and Louisiana Gulf coasts, it represents a \$21 billion-plus investment in national security (\$4 billion for facilities; \$17 billion for oil acquisition).

Should the President decide to tap the emergency stockpile, SPR crude oil can begin flowing to U.S. markets in as little as 13 days. In the aftermath of delivery disruptions caused by damage in the Gulf Coast by Hurricane Katrina in 2005, loans from the SPR played a critical role in stabilizing the nation's oil supplies. The Energy Policy Act of 2005 directs the Secretary of Energy to fill the SPR to an authorized 1 billion barrel capacity, requiring the U.S. Department of Energy (DOE) to complete proceedings to select sites necessary for expansion. At current levels, the initial maximum drawdown rate is 4.4 million barrels per day.

FE manages the daily operations of the SPR from its New Orleans, LA, office. Federal and contract personnel are also stationed at the Reserve's four storage sites: the West Hackberry and Bayou Choctaw sites in southern Louisiana

and the Bryan Mound and Big Hill sites along the coastline of Texas.

THE NORTHEAST HOME HEATING OIL RESERVE is a 2 million barrel supply of emergency fuel oil for homes and businesses in the northeastern United States, where about 69 percent of American households using heating oil are located.

Established in 2000, the Reserve is an "emergency buffer" that can supplement commercial fuel supplies should the heavily oil-dependent region be hit by a severe disruption in supplies. Two million barrels would give Northeast consumers a cushion of supplies for about 10 days, the time required for ships to carry heating oil from the Gulf of Mexico to New York Harbor.

FE manages the Northeast Home Heating Oil Reserve from its Washington, DC, headquarters. To hold the emergency stocks, commercial storage capacity is leased from private companies operating terminals in Woodbridge, NJ; New Haven, CT; and Providence, RI.

Should a fuel crisis develop, FE has in place a rapid competitive sales process that would use an internet-based online auction system. Emergency fuel oil could be delivered from the Reserve to customers in as little as one to three days.

February, 2006



OFFICE OF FOSSIL ENERGY (FE) FACILITIES DEVELOP INNOVATIVE TECHNOLOGIES

FE OPERATES TWO KEY FACILITIES AIMED AT DEVELOPING INNOVATIVE FUTURE FOSSIL ENERGY TECHNOLOGIES — THE NATIONAL ENERGY TECHNOLOGY LABORATORY (NETL) AND ROCKY MOUNTAIN OILFIELD TESTING CENTER (RMOTC).



NETL is the only U.S. national laboratory devoted to fossil energy

research and supports the Department of Energy's (DOE) mission to advance the national, economic and energy security of the United States. NETL has locations in Morgantown, WV; Pittsburgh, PA; Tulsa, OK; Albany, OR; and Fairbanks, AK, but its reach extends to contracted research in 47 states and more than 40 foreign countries. NETL's research portfolio includes more than 1,400 projects with a total value of nearly \$8 billion and private sector cost-sharing of almost \$4 billion. NETL programs are aimed at enabling domestic coal, natural gas, and oil to economically power the nation's homes, industries, businesses, and transportation sectors in an environmentally conscious manner. Among other duties, NETL conducts research in clean power generation, hydrogen fuel cells, and climate change mitigation; manages research partnerships in energy efficiency and renewable energy; and supports DOE's Office of Electricity Delivery and Energy Reliability. In addition to research conducted on site, the majority of NETL's funding is focused on research and development (R&D) partnerships, cooperative R&D agreements, financial assistance, and contractual arrangements with universities and the private sector. The laboratory also supports educational initiatives at all levels. These combined efforts focus a wealth of scientific and engineering talent on creating commercially

viable solutions to national energy and environmental problems.

RMOTC conducts technology research that contributes to the nation's energy security, economic growth, or technology leadership. Its testing capabilities include not only a focus on oil and gas production, but also drilling, renewable energy, flow assurance, bioremediation, wetlands creation, well completions, and geology and petrophysics. The Center's partners include service companies and equipment manufacturers who test new ideas and products leading to increased recovery or reduced operating costs. In addition, national laboratories and government organizations can field test theoretical laboratory assumptions in a real world setting. Universities teaching theory in the classroom can demonstrate real-life field application. RMOTC project management and administrative offices are located in Casper, WY, but the Center's primary test site is a 10,000 acre operating oil facility at the Naval Petroleum Reserve No. 3 (NPR-3) Teapot Dome field. Limited field testing is also conducted at the NPR-2 Buena Vista Field near Bakersfield, CA. An expansion of the Center will result in testing services for new technologies in coalbed methane and oil shale development, produced water management, carbon dioxide (CO₂) flooding and carbon sequestration.

February 2006